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Biocultural Homogenization in Urban Settings: Public Knowledge of Birds in City Parks of Santiago, Chile

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Abstract: An understudied consequence of growing urbanization is the rapid and concurrent loss of native biological and cultural diversity. Here, we measured the concordance between avian species richness in public green areas of the city of Santiago, Chile, and the corresponding knowledge of local citizens of this avian diversity. To assess this correspondence, we sampled avian species richness in 10 representative city parks and surveyed the awareness of avian diversity by park visitors as well as their ability to identify bird species. We found no significant relationship between estimated bird diversity from field sampling and their perception by park visitors, suggesting that visitors underestimate avian diversity in city parks because they perceive only a small fraction of the overall diversity, with their awareness especially biased towards the most abundant species. Exotic bird species comprise the majority of the latter group. This result was observed regardless of whether the city park had high or low bird diversity. Public knowledge of birds did not relate to the species richness present at city parks, and was strongly biased towards the most abundant, widely distributed, and primarily exotic species. This result agrees with the biocultural homogenization hypothesis, documenting the role of urban areas in this global process.

Keywords: biocultural homogenization; urban ecology; urban birds; socioecology; biotic homogenization

1. Introduction

Today, more than half of the world's population lives in cities [1] and rapid urban expansion is considered an important threat to biodiversity worldwide [2,3]. Overall, degradation and loss of wild habitats due to urbanization negatively affects local bird species' richness and abundance [4], leading to dominance by few species that are widespread across different urban settings, thus reducing biotic distinctiveness and enhancing biotic homogenization globally [5,6]. In addition to rapid biotic homogenization in urban settings, we must add a concomitant strong tendency towards "biocultural homogenization" [7]. This concept implies the loss of awareness and willingness to conserve local nature due to the "extinction of experience" or the lack of face-to-face encounters with local biodiversity [8]. Consequently, biocultural homogenization is a more general and prominent driver of global change that explains the concurrent loss of native species and knowledge of diversity, with their eventual massive replacement by cosmopolitan or exotic species, hand-in-hand with the rise of foreign languages and cosmopolitan cultures [7,9,10].

As an example of this global homogenization process, Rozzi et al. [11] analyzed the origin of the flora of urban parks (i.e., central plazas) from eight major cities in southern Chile, documenting that the overwhelming majority of planted trees (~95%) were brought in from Europe, Asia, and North America. Moreover, when people living in these same cities were asked to recall the names of three plant species they had seen in their neighborhood, more than 75% of the respondents could only name exotic species. Roses, apple trees, and tropical palms were among the top five plant names cited, regardless of the city where the survey was conducted [12]. More recently, Ballouard et al. [10] found that French schoolchildren, strongly influenced by the media, which is overly dominated by a few iconic, and usually non-native species, were more prone to protect unseen, alien species, rather than local native animals.

Despite the massive internationalization of biota through exotic invasions and deliberate introductions, there is increasing evidence that people tend to have positive responses to—and generally perceive broad benefits from—increased levels of native biodiversity [13–16]. However, the relationship between peoples' perceptions and measured local biodiversity has not yet been conclusively established in field studies. For instance, Fuller et al. [13] found a significant positive relationship between perceived and observed richness for plants by the inhabitants of Sheffield, UK, and a marginally non-significant positive relationship for bird species richness. However, four years later, Dallimer et al. [16], in the same city, failed to observe a significant relationship between peoples' perceived richness and local species richness of plants, birds, and insects. To address the causes of this knowledge loss, reflected by this lack of relationship between perceived and actual biodiversity, Shwartz et al. [17] experimentally increased the diversity of flowers, birds, and pollinators in small public gardens of Paris, France, demonstrating that people did not notice the increase in species richness, despite their strong fondness for a richer site diversity, with the exception of insects. Finally, Lindemann-Matthies et al. [18] found that the mean perception of plant richness by people in German cities increased linearly with true species richness.

Evidence suggests that to enhance public knowledge of local ecological systems and peoples' willingness to conserve nature, it may be critical to deepen our understanding of the connection between biological and cultural diversity by integrating local biodiversity knowledge into new educational programs and novel environmental policies [16].

To address this concern in cities, we should learn more about the relationship between actual biodiversity of urban greenspaces and the citizens' perceptions and valuations of this natural heritage in urban contexts. This analysis is especially relevant for high biodiversity areas of South America [13,18,19]. Most studies of biodiversity in urban settings have been conducted in places where there is a long tradition of wildlife appreciation by city residents, for instance, bird watchers in cities of the United Kingdom [20]; however, we lack information about the rapidly growing urban environments of South America. The ancient urban settings of the northern hemisphere usually contrast sharply with the more recent and rapidly growing urbanization observed in developing countries, especially Latin America, where the baseline citizen's knowledge of biodiversity in urban areas has not been fully assessed.

Accordingly, in this article, we first ask the question of how much knowledge do the people living in the large metropolitan area of Santiago, Chile—a city with more than 6 million inhabitants—have of the avifauna present in urban greenspaces; then, we evaluate the citizens' perceptions of avian species richness against bird species richness records obtained from field assessments in the same locations, and finally, we explore the citizens' motivations for watching birds in urban parks. Given the fast pace associated with the loss of direct experience with nature and biocultural homogenization in large cities [7], we expected that peoples' knowledge of exotic urban birds (which are widely distributed in urban areas) should exceed that of native, less conspicuous, and endemic birds' characteristic of central Chile, where the city of Santiago is located. This prediction emerges from the fact that biocultural homogenization tends to produce an imbalance in favor of foreign and charismatic species [10].

2. Materials and Methods

2.1. Study Area

As a part of a one-year seasonal monitoring of birds in urban parks within the boundaries of the city of Santiago, Chile, we surveyed birds in a subsample of 10 urban parks (Table 1; Supplementary Material 1). Santiago is the largest city of Chile, concentrating more than 50% of the country's human population, and located at the heart of the Chilean Mediterranean-climate region, a recognized global biodiversity hotspot for vascular plants and vertebrates [21]. The city parks selected for this survey varied broadly in size, number of woody plants, and tree cover to ensure representativeness of the city's green areas. These parks were a subset from a larger sample of urban parks in Santiago ($n = 50$), where birds are currently being monitored.

2.2. Bird Sampling

For this research, fieldwork was conducted in the austral spring of 2014, between October and November. We sampled bird species richness in each city park using fixed 25-m-radius point-counts of all birds seen and/or heard by trained ornithologists during an 8-min period [22]. Bird surveys were conducted on weekdays between 06:00 and 10:00 a.m., and only during clear and calm days.

In medium- and large-sized parks (Table 1), point-counts were separated by 200 m. However, in small parks less than 1.75 ha in size (Table 1) only one 25-m radius point count station could be sampled, since replicate point counts did not comply with the suggested minimum distance of 200 m between sampling points. Therefore, to increase the probability of bird detection in all parks, we conducted repeated sampling for three consecutive days as temporal replicates. Bird occurrences were used to estimate species richness.

Table 1. Mean bird species richness (the total value of bird species' occurrences recorded), samples sizes, number of surveys, and other attributes of the ten city parks studied in Santiago, Chile. Sampling was conducted in spring of 2014. Total sample size for visitor surveys was 141 adults (people over 18 years of age).

Park Name	County within Santiago City	Coordinates		Park Size (ha)	Total Bird Richness	Sampled Points	Visitors Surveyed
		Latitude S	Longitude W				
Parque Bicentenario	Vitacura	33°23.725′	70°36.086′	60.0	22	4	14
Parque Araucano	Las Condes	33°24.137′	70°34.378′	29.2	19	4	14
Parque Juan Moya	Ñuñoa	33°27.970′	70°35.337′	15.0	18	4	14
Parque Santa Rosa	Las Condes	33°25.080′	70°32.364′	7.0	12	2	14
Plaza Las Lilas	Providencia	33°25.650′	70°35.677′	2.2	11	2	14
Plaza Isabel La Católica	Las Condes	33°25.612′	70°34.729′	0.6	12	1	16
Plaza Del Inca	Las Condes	33°24.792′	70°34.211′	1.1	5	1	14
Parque Alcalde Chadwick	La Reina	33°26.118′	70°33.469′	2.0	6	2	14
Plaza Sebastian El Cano	Las Condes	33°25.676′	33°25.676′	0.8	18	1	14
Plaza Castillo Velasco	Ñuñoa	33°27.578′	70°35.487′	0.2	12	1	13

2.3. Citizen Surveys

To investigate peoples' perceptions of avifaunal richness and knowledge of bird identities, we designed a questionnaire and conducted a survey to visitors to each park (Supplementary Material 2). The survey had three types of questions: First, to assess public knowledge and ability to identify bird species, each person was asked to name the first bird species that came to his/her mind. Then we showed them a set of 10 pictures of birds commonly found in urban areas of Santiago, asking each person to identify the birds by their local name. The pictures shown were selected from our field data and included seven native and three exotic bird species, all of them were the most frequently found birds in Santiago city parks (Table 3, Supplementary Material 2). Second, to assess peoples' perceptions of bird richness, we asked each person to provide an estimate of how many bird species they believed should be found in the park where the survey was conducted, and asked them whether this was a high or low number, based on their personal experience watching birds in urban and non-urban environments in central Chile. Third, we queried each person about their motivations for visiting city parks and their level of interest in bird watching. Before conducting the survey, we tested its applicability and performance with 25 persons outside the academic environment, both with and without academic backgrounds. In this survey, subjects were asked to answer each question following the "think-aloud" method [23]. In this way, we ensured that respondents, independently of their academic background, correctly understood the questions before answering the survey. Data from this preliminary trial were used for validation purposes only and were not included in the analysis.

Field surveys designed to explore biocultural knowledge of birds by park visitors were applied during the spring of 2014, a time when city parks were most visited and bird activity was at its peak. Fourteen adults (persons over 18 years of age) were surveyed in each city park, with the exception of one large and one small park where we completed 16 and 13 surveys, respectively, for a total sample of 141 respondents that were willing to answer the questionnaire (Table 1). Surveys were performed on weekdays from 11:00 to 18:00. Respondents were selected from park visitors on three different days to avoid sample biases. In general, no more than five people were surveyed each day from each city park, with the exception of the park "Plaza Isabel La Católica" where six persons were surveyed in a single day (Table 1). Our respondents were predominantly Chilean (96%), residents in Santiago (99%), included both sexes (41% female, 59% male), a broad range of ages (18 to 86 years old), and more than 78% declared having higher education levels (i.e., university or college). Additionally, 68% of the respondents (97 out of 141) identified themselves as frequent visitors of city parks, meaning that they visited at least one park per month.

2.4. Ethics Clearance

Research was conducted in accordance with and following approved regulations by the Pontificia Universidad Católica de Valparaíso Bioethics committee. Before completing the survey, respondents gave explicit consent, stating their agreement to participate in the survey. Respondents were also asked to confirm that they were over 18 years of age.

2.5. Statistical Analysis

Our model related perceived avian species richness to actual park species richness assessed in field sampling. Bird species richness was calculated as the total value of bird species' occurrences recorded in sample points within city parks. In each park, repeated observations were made over three consecutive days, because time replication was considered necessary to minimize detection problems of rare birds. The cumulative value of these three temporal replicates was taken to represent point richness asymptotic estimates for each sampled site. Perceived species richness was obtained from survey data applied to a grand total of n = 139 respondents, because two incomplete questionnaires were discarded.

After initial inspection, we proposed several candidate models with alternative functional forms to relate perceived and actual bird species richness observed in city parks. In addition, park size was included as a co-variable in these models to account for potential effects due to differences in park green area (Table 1). A total of eight candidate models were specified (Table 2), and the most likely model was chosen using an information theoretic model selection approach [24]. All candidate models were analyzed as generalized linear mixed models, assuming a Poisson distribution of errors. Candidate models were compared using Akaike weights [24]. Analyses were conducted in R [25] using library *lme4* [26] for generalized linear model fits, and library *pgirmess* [27] for model comparison. Inspection of residual plots did not reveal strong heteroscedasticity, and Cleveland plots did not suggest that any outliers needed to be removed [28].

Table 2. Candidate models evaluated.

No.	Model Specification	Description
1	$R_{perc} = \alpha$	Intercept only model
2	$R_{perc} = \alpha + offset(\log S_{park})$	Park size offset on perceived avian richness.
3	$R_{perc} = \alpha + \beta_1 R_{park} + offset(\log S_{park})$	Linear relationship between park avian richness plus sampling offset of park area on the perceived avian richness.
4	$R_{perc} = \beta_1 S_{park}$	Linear effect of park size on perceived avian richness.
5	$R_{perc} = \alpha + \beta_1 R_{park} + \beta_2 R^2{}_{park}$	Second-order polynomial effect of park avian richness on perceived richness.
6	$R_{perc} = \alpha + \beta_1 R_{park} + \beta_2 S_{park} + \beta_3 R_{park} \times S_{park}$	Interactive effect of park avian richness and park area.
7	$R_{perc} = \alpha + \beta_1 R_{park} + \beta_2 R^2{}_{park} + \beta_3 S_{park}$	Second order polynomial relationship between perceived richness and park richness, plus additive effect of park size
8	$R_{perc} = \alpha + \beta_1 R_{park} + \beta_2 R^2{}_{park} + offset(\log S_{park})$	Second order polynomial relationship between perceived richness and park richness, plus an offset to park size

R_{perc} = perceived avian richness (number of species), R_{park} = park avian richness (number of species), S_{park} = park size area (ha). Park identity was modeled as a random effect in all models.

3. Results

3.1. Bird Species Richness

Overall, 22 bird species were recorded in our sampling of 10 Santiago city parks, three of these species were introduced or cosmopolitan (Table 3). Bird species richness varied among different parks (Table 1), with maximum and minimum of 22 and 5 species/park, respectively. Among the most frequent and abundant bird species in Santiago city parks were the native Austral Thrush (*Turdus falcklandii*), the Eared Dove (*Zenaida auriculata*), and two introduced and widespread species, the Rock Dove (*Columba livia*), an old introduction from the 1930s, and the Monk Parakeet (*Myiopsitta monachus*), a more recent introduction from the 1980s. From these 22 species, 18% were observed in less than three city parks (Table 3). We found an overall similarity of 50% in bird species composition among all the surveyed parks (Morisita's Index of dissimilarity = 0.57).

Table 3. Origin, mean abundance (birds/point/day/season), and frequency of occurrence of all bird species detected in the city parks studied in Santiago, Chile.

Scientific Names	Local Names	Origin	Mean Abundance (Birds/Point/Day) ± SD	Frequency of Occurrence (n = 10)
Turdus falcklandii	Austral Thrush	Native	7.88 ± 9.05	1
Columba livia	Feral Dove	Exotic	5.16 ± 7.35	0.8
Myiopsitta monachus	Monk Parakeet	Exotic	4.01 ± 7.15	0.9
Zenaida auriculata	Eared Dove	Native	3.42 ± 4.23	1
Zonotrichia capensis	Rufous-collared Sparrow	Native	2.27 ± 2.33	0.8
Molotrhus bonariensis	Shiny Cowbird	Native	1.28 ± 6.06	0.6
Vanellus chilensis	Southern Lapwing	Native	0.88 ± 4.14	0.4
Agelaius thilius	Yellow-winged Blackbird	Native	0.79 ± 3.53	0.1
Curaeus	Austral Blackbird	Native	0.77 ± 1.84	0.7
Troglodites aedon	Southern House Wren	Native	0.65 ± 0.86	0.5
Sporagra barbata	Black-chinned Siskin	Native	0.53 ± 2.07	0.3
Passer domesticus	House Sparrow	Exotic	0.52 ± 1.10	0.5
Elaenia albiceps	White-crested Elaenia	Native	0.44 ± 1.16	1

Milvago chimango	Chimango Caracara	Native	0.42 ± 0.93	0.7
Anairetes parulus	Tufted Tit-Tyrant	Native	0.39 ± 0.73	0.5
Phytotoma rara	Rufous-tailed Plantcutter	Native	0.35 ± 0.92	0.8
Diuca	Comon Diuca-Finch	Native	0.31 ± 0.77	0.5
Leptasthenura aegithaloides	Plain-mantled Tit-Spinetail	Native	0.31 ± 0.61	0.6
Mimus thenca	Chilean Mockingbird	Native	0.28 ± 0.70	0.4
Sturnella loyca	Long-tailed Meadowlark	Native	0.25 ± 0.90	0.2
Tachycineta meyeni	Chilean Swallow	Native	0.24 ± 0.93	0.4
Sicalis luteola	Grassland (Misto) Yellow-finch	Native	0.02 ± 0.27	0.1

3.2. Citizen Surveys

To the first question in the survey ("What are the first bird names that come to your mind?"), more than 57% of the respondents (n = 141) first named exotic birds. Among the five most cited species by the respondents (Supplementary Material 2, Table S1) three were introduced species and two were native ones. The three introduced species mentioned by respondents were the Rock Dove (*Columba livia*; 31%), the Monk Parakeet (*Myiopsitta monachus*; 18%), and the House Sparrow (*Passer domesticus*; 8%). The two native species named by respondents were the Austral Thrush (*Turdus falcklandii*; 13%) and the Eared Dove (*Zenaida auriculata*; 8%).

Regarding the ability to identify bird pictures, nearly all respondents recognized at least one out of the 10 species illustrated; however, nobody was able to recognize all 10 species presented to them in the survey (Figure 1). Among the respondents, 38% (n = 52) recognized two species, and only 1% (n = 2), correctly recognized nine of the 10 bird species presented (Figure 1). From the three most commonly recognized bird species in the pictures, two were non-native and widespread, (the Rock Dove, *Columba livia*, and Monk Parakeet, *Myiopsitta monachus*), and the third species was the native Eared Dove (*Zenaida auriculata*). The small native Tufted Tit-Tyrant (*Anairetes parulus*) was the least recognized among the pictures shown.

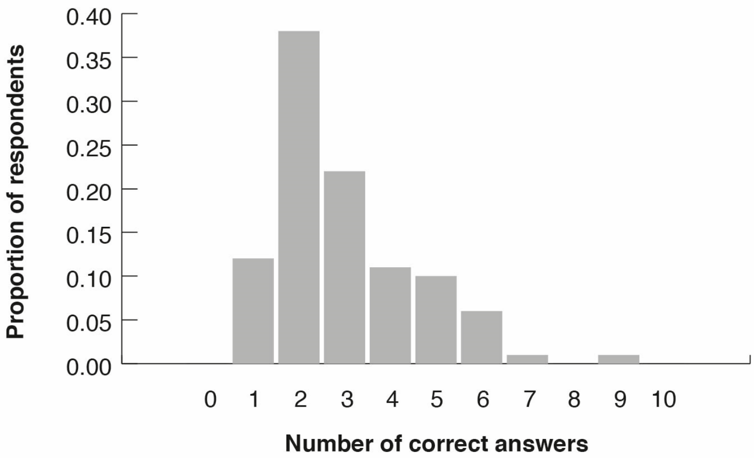

Figure 1. Number of images (photos) of commonly encountered birds in city parks (out of a maximum of 10) that were correctly identified by visitors interviewed at each site. We presented the respondents with the following bird images (Supplementary Material 2): House Wren (*Troglodytes aedon*), Austral Thrush (*Turdus falcklandii*), Eared Dove (*Zenaida auriculata*), Rufous-collared Sparrow (*Zonotrichia capensis*), House Sparrow (*Passer domesticus*), Rock Dove (*Columba livia*), Chilean Mockingbird (*Mimus thenca*), Austral Blackbird (*Curaeus curaeus*), Monk Parakeet (*Myiopsitta monachus*), and Tufted Tit-Tyrant (*Anairetes parulus*).

From the total number of correct identifications (n = 417) of the pictured birds, only 34% (n = 143) of those identifications were of native species, while 66% (n = 274) of the correct names were those of the three non-native species occurring in city parks. Furthermore, only persons who were able to identify more than five bird species in the set of pictures shown named three or more native birds (Figure 2). Additionally, we noted that the number of correct answers did not differ statistically between respondents with and without academic background (Mann-Whitney U Test, $Z = 0.06$, $p = 0.95$).

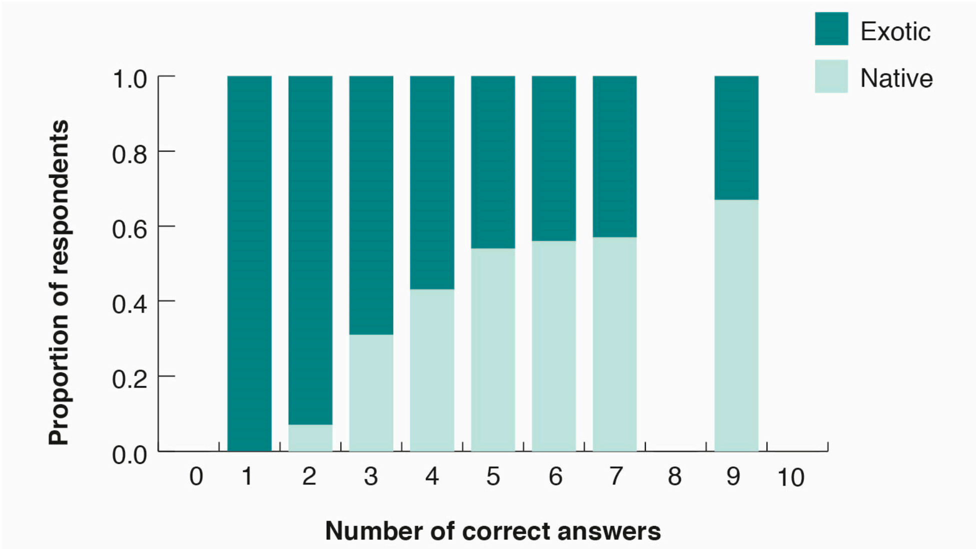

Figure 2. Proportion of native versus exotic bird species identified from a selection of images of ten bird species.

3.3. Peoples' Perceptions of Bird Diversity

Model selection indicated that the best model fit for the relationship between perceived and actual avian species richness was an intercept-only model (candidate Model 1 in Table 4, Figure 3). This model suggests that people perceive no more than four species on average (Figure 3), implying that people tend to underestimate bird species richness in the parks. Complementing this result, 82% of respondents in our study considered that their perceived bird species richness was lower than it would be expected from their personal experience watching birds in urban and non-urban environments in central Chile, and only 15% of respondents thought that their perception was higher than their expectation.

Table 4. Model selection results. Candidate models are ordered in descending order of relevance according to Akaike weights. Model numbers according to Table 2.

Model	*LL*	*AICc*	Δ *AICc*	*wic*
1	−307.3	618.67	0.00	0.41
4	−306.8	619.76	1.09	0.23
6	−304.7	622.10	1.16	0.23
5	−306.7	622.36	2.98	0.09
7	−306.4	623.15	4.54	0.04
8	−319.1	656.59	27.76	0
3	−321.8	656.76	31.16	0
2	−326.3	656.97	38.10	0

LL = Likelihood, *AICc* = corrected Akaike information criteria, *ΔAICc* = Delta AIC, *wic* = information criteria weight.

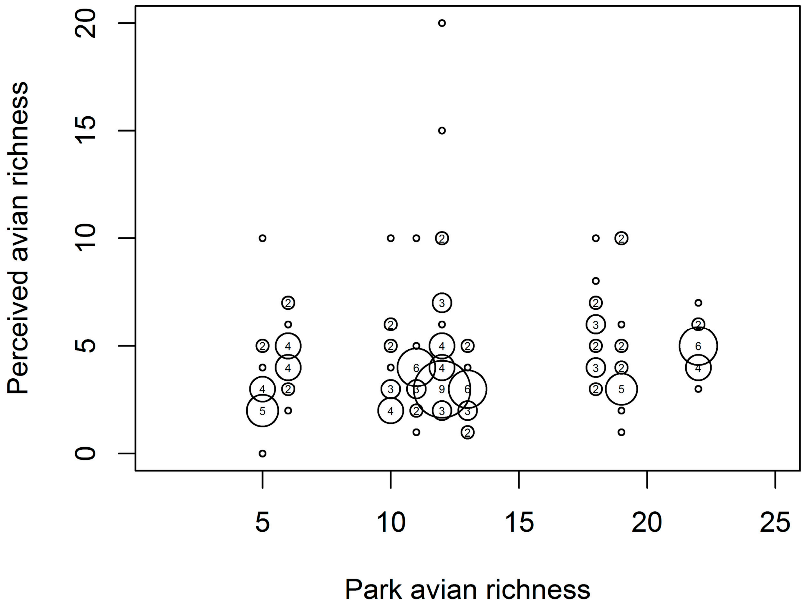

Figure 3. Relationship between the actual avian species richness of city parks detected during field surveys (park avian richness) and species richness perceived by city park visitors. Numbered dots indicate the number of overlapping data points.

3.4. Birding Attitudes

More than 70% (n = 141) of the respondents indicated that they watched birds in city parks because of the pleasurable sensation derived from hearing birds sing, noting the colors of the bird's feathers, and the feeling of relaxation that bird watching produces. Surprisingly, only 10% of the respondents declared that they were not interested in bird watching at all or that they disliked birds (Figure 4). Finally, more than 96% of the respondents (n = 141) declared their willingness to learn more about birds in city parks.

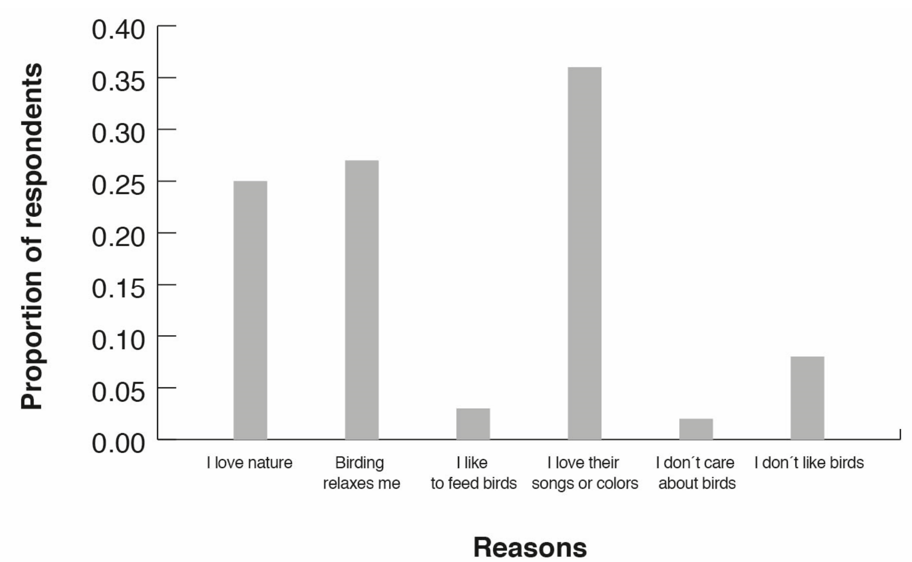

Figure 4. Main motivations to become engaged in bird watching declared by visitors of city parks in Santiago, Chile.

4. Discussion

4.1. Bird Diversity in Santiago City Parks

Despite the fact that we included in this survey only data from spring 2014, the number of bird species recorded overall ($n = 22$) was similar to the figure reported in previous studies for urban birds in the city of Santiago. For example, after surveying a comparable amount of greenspace, Estades [29], Díaz and Armesto [30], and Urquiza and Mella [31] reported 17, 27, and 22 bird species, respectively. Regarding their provenance, 13% of the birds recorded were listed as exotic ($n = 3$), a proportion similar to that reported by a comparable study conducted in urban parks of the city of Sheffield, where 10% of the 49 bird species surveyed were exotic [16].

4.2. Peoples' Ability to Identify Birds in City Parks

The most frequently named birds were cosmopolitan species occurring in cities worldwide, which were widespread in Santiago's urban setting. The relationship of citizens' knowledge with bird abundances was marginally significant (Supplementary Material 2, Table S2a), suggesting that bird abundance may influence the knowledge of species by people in our urban area. Moreover, despite the relatively low bird species diversity found in the studied urban parks, most respondents of the survey were unable to name more than a few species when shown pictures of 10 species. The species named were primarily exotic species that together accounted for less than 14% of the urban bird assemblage. Only respondents who correctly identified at least five of the 10 bird species presented in the pictures knew the names of more than three native bird species. In this context, the ability of a park visitor to identify a bird in the pictures is positively and significantly related to bird abundance (Supplementary Material 2, Table S2b), a result that reaffirms the idea that the ability to name birds responds directly to the presence of widespread cosmopolitan species, which in turn agrees with the biocultural homogenization hypothesis [7,10].

On the other hand, we found that the occurrence of birds across parks was not related to the ability of the respondents to name or recognize species. For example, two infrequently named native birds, the Tufted Tit-Tyrant (*Anairetes parulus*) and the House Wren (*Troglodytes aedon*), are relatively inconspicuous small birds that often hide inside bushes, but are present in almost every city park in Santiago.

A surprising result was that at least three native bird species that were equally abundant or as frequent as exotic species (Table 1 and 3) did not rank high in the bird identification survey. The failure of city park visitors to identify common native species has been previously reported for other taxa inhabiting urban areas, such as plants, butterflies, and birds in Sheffield, UK [16]. However, our result contrasts with results reported by Robinson et al. [31], where the inhabitants of Cornwall, UK, correctly identified 60% common plant species, but were significantly worse at naming non-native plants. In our case, among the 19 native bird species, the Austral Thrush was the best-known species for park visitors. This is a relatively abundant, large-sized bird, which is frequent and conspicuously visible in Chilean parks and home gardens [32], often using lawns and the open ground for feeding. The deficient knowledge of native birds shown by urban park visitors in Santiago contrasts sharply with the long history of appreciation of the biological heritage documented, for example, in the traditional knowledge of Chilean indigenous cultures [33,34] reported in a recent a review of traditional ecological knowledge [35] and popular folklore [36]. In fact, Ibarra et al. [37] indicate that out of 84 popular proverbs in the Chilean folklore, native birds inspired 64.

Bird abundance in urban settings seems to be an important factor that promotes the recognition of some species. Therefore, since one of the consequences of biotic homogenization is the reduction of species richness and abundance of native species in favor of widespread exotic species [38], reducing the loss of knowledge of the native biota and slowing biocultural homogenization trends would require the modification of urban habitats and landscapes to enhance the distribution, species richness, and abundance of native birds in city neighborhoods.

4.3. Drivers of Biocultural Homogenization (Responsible for Limited Peoples' Perceptions of Avian Diversity in City Parks)

The significant loss of biodiversity knowledge among citizens of Santiago is reflected in the general ignorance about the identity of native bird species, which can be understood in the light of the biocultural homogenization hypothesis. We recognized two possible drivers of biocultural homogenization and the loss of local biodiversity knowledge in this case:

(i) Low proportion of greenspace per inhabitant within the city of Santiago: The consequence is that citizens find limited opportunities for direct encounters with local biodiversity, the so-called "extinction of experience" [8,9]. The area of greenspace available for direct encounters between people and wildlife can affect the residents' familiarity with local biological diversity. In fact, the city of Santiago has a growing population of more than six million people with an average of only 4.5 m^2 of greenspaces per capita, a ratio far below the 9 m^2 recommended by the World Health Organization [39]. Consequently, citizens of Santiago have limited access to green areas where they can observe and learn about native biodiversity, despite the fact that more than 70% of the park visitors surveyed by us expressed their fondness for bird watching. Interestingly, Pilgrim et al. [40] proposed that the loss of ecological knowledge tends to be stronger among the inhabitants of more developed and urbanized countries with higher GDP (e.g., UK from 2010 to 2014 with a GDP of $41,836 USD [41]), in contrast to more rural and low-income countries (e.g., Indonesia with a GDP from 2010 to 2014 of $3521 USD [41]). In the case of Chile, with a GDP of $14,590 USD (2010–2014) [41] the situation should resemble that of lower-income countries. However, considering the biased distribution of world GPD, with a median of $5866 ($n$ = 245 countries) [41], Chilean GPD is closer to the high-income and urbanized countries (percentile 75), with a current proportion of urban population that reaches 87% [42]. From our results, it seems likely that recent generations of city dwellers lack a relationship with rural environments, but further research is needed to explore this process. Similar to most Latin American cities, Santiago has been undergoing an intense process of urban densification in recent decades [43]. This process has led to the replacement of many residential neighborhoods, featuring houses with backyards, by apartment buildings, which means that a large proportion of the population currently has less access to greenspace where they can observe bird life in comparison to past residents.

(ii) Taxonomic bias induced by the media in favor of iconic or exotic species: People in cities are strongly influenced by information from the media (i.e., movies, children's TV, books, social networks), and notably from the Internet. However, information about wild species in the media concentrates largely on a few iconic, appealing, and often exotic species [10]. For example, an analysis of 1254 schoolbooks and children's books accessible to citizens of Santiago showed that illustrations and narratives were dominated by charismatic species and landscapes from Africa and the Northern Hemisphere (particularly Europe), with sparse reference to Chilean native biodiversity [44]. A similar phenomenon may be occurring in other Latin American countries where urbanization is expanding rapidly. For example, in the Andean region of Cuenca, Ecuador, Rozzi [7] found that roses and exotic plants prevailed in classroom decoration and in textbooks used in rural schools, ignoring the notably rich native flora and fauna occurring outside the school. A frequent consequence of this bias towards exotic species in literature, schools, and the media is the substitution of common local names by exotic ones. In our survey of park visitors in Santiago, most of the respondents erroneously identified the native Austral Blackbird as a North American or European Crow (13 out of 17 respondents), a group of birds that is not present in Chile or in South America.

Biased public knowledge of biodiversity, with particular emphasis on charismatic species, has been previously documented. For instance, Nemesio et al. [45] reported that charismatic vertebrates were much more frequently represented on stamps than members of less charismatic groups (e.g., insects), even in comparison to those having much greater local diversity. This fact supports the argument of Weilbacher [46] that people will only realize that a species has been lost when they already know it and have developed some kind of connection with it. Interestingly, an ongoing process that could reverse the popular ignorance about birds in Chilean cities is the recently growing trend to hold regional festivals, focused on local avifauna. Among the best examples of this are the regional bird festivals held at Caulín in Chiloe Island (since 2006), at Olmué and Viña del Mar, in Valparaíso (since 2014 and 2008, respectively), and at Curacautin in Temuco (since 2010).

Recent research has revealed that biodiversity knowledge is an important driver of public concern about environmental problems and global change [47]. Accordingly, ecological education is essential to stem current dramatic biodiversity loss [10] and efforts aimed at improving citizens' knowledge of local biodiversity might increase public awareness of the value of biodiversity and encourage positive attitudes towards nature.

4.4. Biodiversity and Human Wellbeing

Many authors have argued for and/or documented a positive relationship between biodiversity and human wellbeing, a connection that is particularly strong in the case of biotic diversity associated with urban greenspaces [13–15,48]. Access to information about native biodiversity is essential to maintain this positive attitude. Indeed, Dallimer et al. [16] proposed that poor knowledge of local biodiversity was the main reason for the lack of a consistent relationship between species richness (i.e., diversity of birds, plants, and butterflies) and the psychological wellbeing of visitors to urban greenspaces in the UK. Additionally, Olive [19] showed that urban residents lack awareness about endangered species and feel very little responsibility for conservation or environmental policy in two Canadian cities compared, for example, with people living in rural areas. Furthermore, Cox and Gaston [49] found a strong correlation between the number of bird species that a person could correctly identify and their sense of wellness. Likewise, residents of Morelia, Mexico, positively associated urban trees and their diversity with human wellbeing; while people from Morelia were favorable to both native and exotic tree species, they preferred native trees to exotic ones [50].

As expected, most people in our survey perceived a lower bird diversity in city parks than the actual bird species richness estimated from field sampling, and no significant statistical relationship was found between perceived and actual avian species richness in city parks, suggesting that peoples' perceptions were limited to about two species per site on average. Moreover, the observed citizens' perceptions are not systematically related to the species richness estimated in the study of parks. Interestingly, average peoples' perceptions coincide with the richness of the poorest parks. Accordingly, biocultural homogenization is currently taking place, as visitors' perceptions saturates at an extremely low value of bird diversity, thus reducing biotic distinctiveness among city parks differing in bird diversity. Interestingly, Cox and Gaston [49] reported that people felt better when seeing a high diversity of bird species in gardens than when observing a greater number of individuals of the same species. Further research is needed to explore the relationship between biodiversity knowledge and human wellbeing in Santiago.

In the parks of Santiago, more than a half of the respondents declared that their perception of bird diversity was lower than expected based on their own experience. This result differs from responses to a similar survey by citizens of Melbourne, Australia, where respondents tend to overestimate biodiversity in urban parks [51], or from other studies where people correctly associated biodiversity levels to landscape images with different levels of human influence [52].

Finally, the concept of biocultural homogenization [7] can be related to the process of "extinction of experience" [8,9], i.e., the loss of knowledge of bird diversity by the citizens of Chile's largest and most rapidly growing city. In this context, we emphasize the need for more detailed studies on the relationship between citizens' perceptions of biodiversity and human wellbeing in Latin American cities, which have a faster pace of urbanization, urban immigration, and a relatively lower, or declining, proportion of green areas per resident compared to northern hemisphere cities. We also argue that enhancing citizens' knowledge of native species might increase their perceived value, which in turn can foster stronger cultural identity and, at the same time, motivate conservation actions to maintain wild species within urban environments.

Supplementary Materials: The following are available online at www.mdpi.com/2071-1050/9/4/485/s1: KMZ file for the geographical location for each studied park (Supplementary Material 1). Full questionnaire in the original language (Spanish), including pictures and names of species used for the survey of bird identification skills; Table S1, First bird species mentioned by 141 respondents in answer to the question "What are the first bird names that come to your mind?"; Table S2 (a) Linear regression between bird abundance (mean birds/point/day) and the frequently named birds, (b) Linear regression between bird abundance (mean birds/point/day) and the number of correct identifications of each species (Supplementary Material 2).

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